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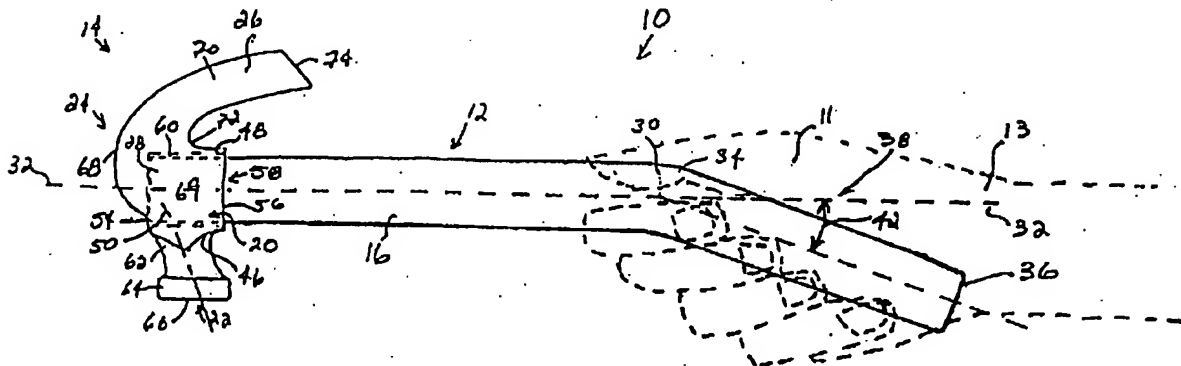
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(54) Title: ERGONOMIC HAND TOOL



(57) Abrégé/Abstract:

The ergonomically improved hand tools include an improved handle which has a handle grip portion set at an angle to the tool head. The angle at which the handle grip is set to the remainder of the tool handle is a compound angle arranged such that the handle grip portion extends laterally of the remainder of the handle and angles downwards vertically into the hand when being gripped. This compound angle has the benefits of the Bennett handle as well as brings the tool head into alignment with the forearm of the individual using the handle which the Bennett handle fails to do. The improved hand tool handle is adaptable for use with most currently used hand tools and may be employed in any application where its use would be appropriate. The ergonomically improved hand tools provide an ergonomically redesigned hammer having the improved handle which reduces the risk of repetitive strain injuries. An extended fulcrum point is located at the top of the hammer head for improving the nail extracting characteristics of the hammer claw. The hammer claw has claw members that are angled relative to one another enabling the claw to access nails located in corners, along baseboards and at other locations where two surfaces meet at an angle. The hammer handle as well as the improvements discussed above includes the further improvement of being made from laminated materials which increases the strength of the hammer handle and helps dampen vibration. An improved paint brush and scissors are also provided. Both the paint brush and the scissors include the improved handle arrangement.

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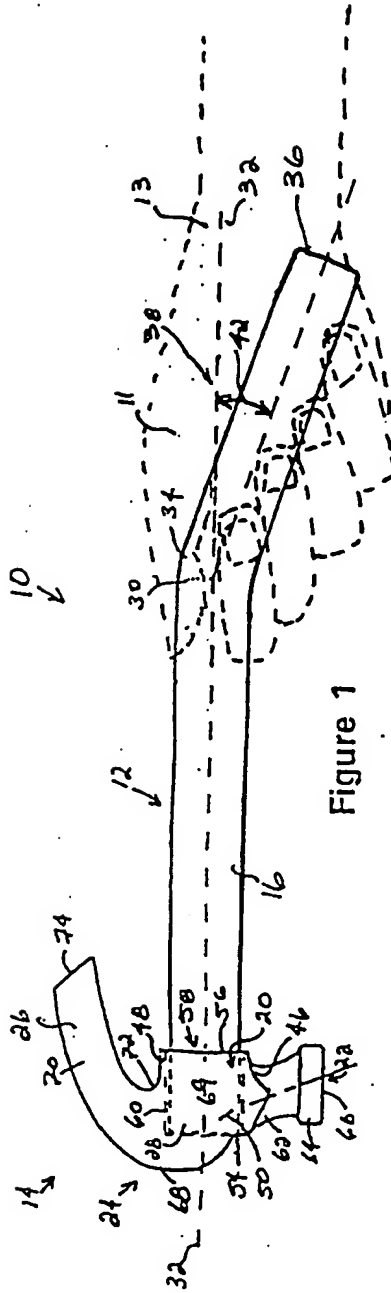


Figure 1

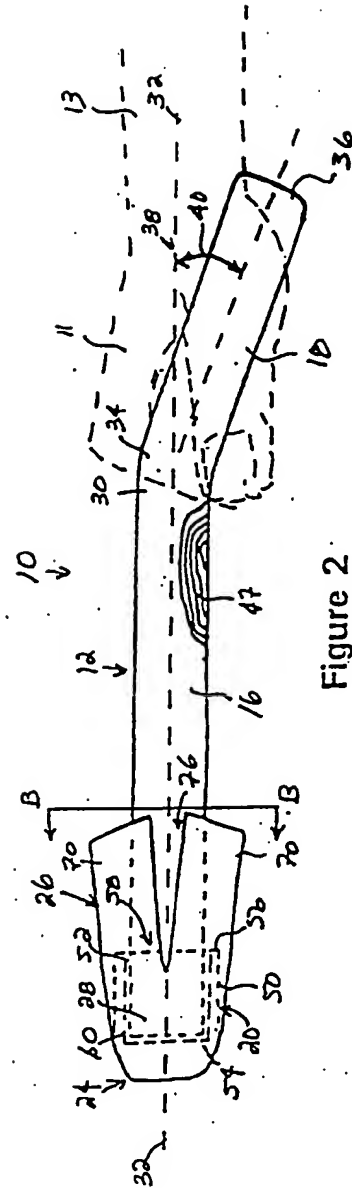


Figure 2

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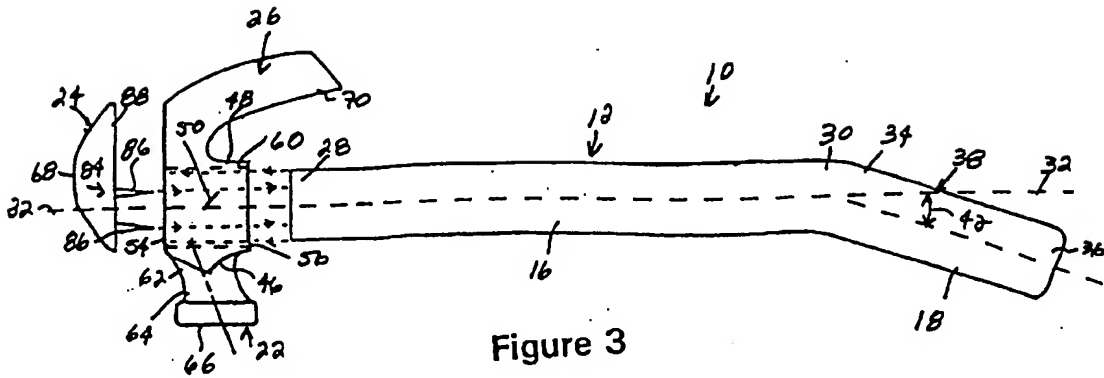


Figure 3

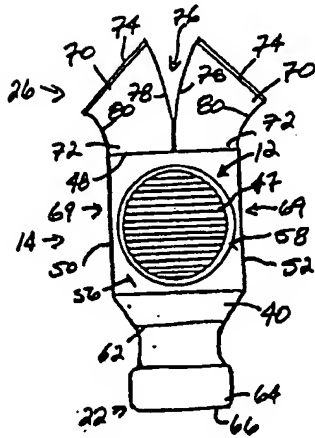


Figure 4

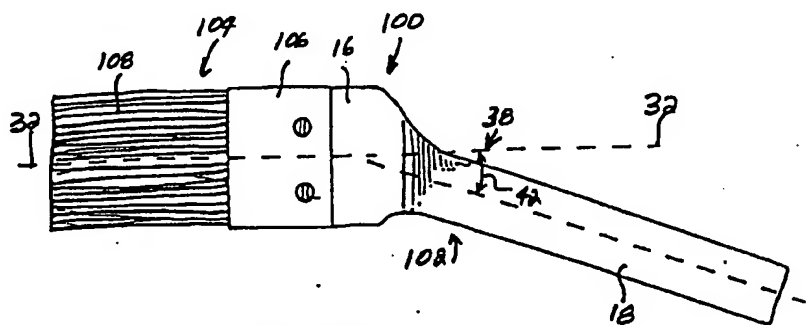


Figure 5

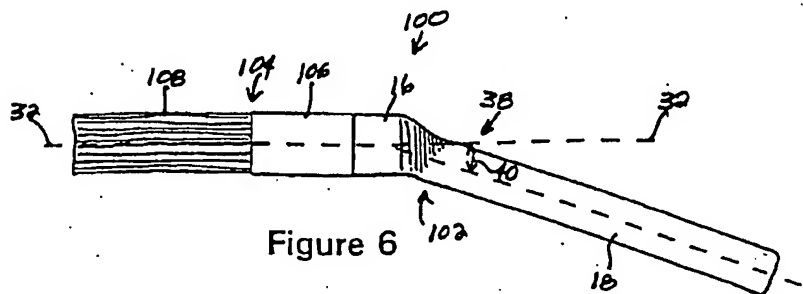


Figure 6

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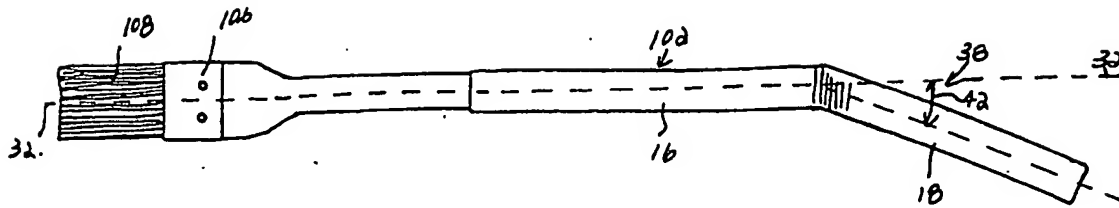


Figure 7

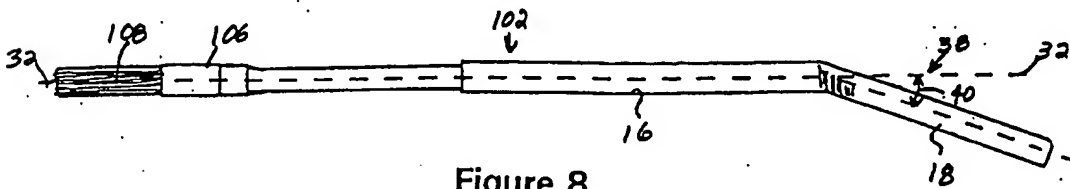


Figure 8

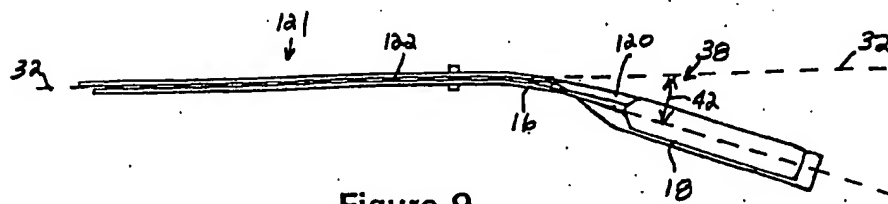


Figure 9

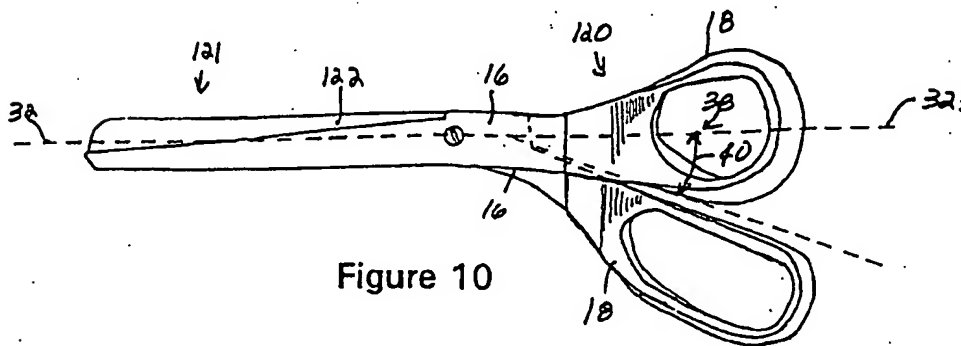


Figure 10

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## **ERGONOMIC HAND TOOLS**

### **FIELD OF THE INVENTION**

The present invention relates to ergonomic hand tools, particularly of the type having bent handles.

### **5 BACKGROUND**

Most hand tools are based on designs which have been around for decades or centuries and can in most cases benefit from improvements in their design made using modern ergonomic and biomechanical design and measurement techniques. Ergonomic hand tools are generally designed to  
10 minimize the effort and strain on the human body while maximizing their efficiency.

Many diseases such as Carpal Tunnel Syndrome, Tendinitis, Bursitis, and Tenosynovitis can be caused by repeated use of poorly designed tools. It is known that hand tools should be designed to limit the motion of the  
15 wrist to the middle third of the range of motion to help reduce the risk of these diseases. Ergonomic hand tools having bent handles to improve the efficiency of the tool and limit the range of motion of the wrist have been known for some time. One example of which is the Bennett handle which provides a curved handle grip which angles vertically downwards into the hand and  
20 follows the line between the index finger and the ball of the thumb. This handle when employed for example on a hammer reduces the range of motion of the wrist and improves the striking angle of the hammer. The Bennett handle however does not bring the tool into alignment with the forearm. This requires that the individual using the tool angle their wrist slightly to bring the

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tool into alignment with the forearm during use. This can result in repetitive strain injuries if the tool is used often or for long periods of time.

Most hand tools have a handle which is substantially straight. This tends to result in the tool head falling in the line of sight of the individual using the tool and obscuring the work area.

#### SUMMARY

The ergonomically improved hand tools include an improved handle which has a handle grip portion set at an angle to the tool head. The handle grip is set at a compound angle to the remainder of the tool handle and is arranged such that the handle grip portion extends laterally of the remainder of the handle and angles downwards vertically into the hand when being gripped. This compound angle has the benefits of the Bennett handle as well as having the additional benefit of bringing the tool head into alignment with the forearm of the individual using the tool which the Bennett handle fails to do.

Add-on components providing the improved handle as well as additional refinements are also provided as a means to improve the characteristics of conventional hand tools.

According to one aspect of the present invention there is provided a hand tool for gripping in a hand of an arm of a person, said arm having a forearm, said hand tool comprising:

- a tool head;

- and tool handle including:

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a first portion having a first end, a second end, and a longitudinal center line extending therethrough, said first portion being fixed at the first end to the tool head;

and a handle grip arranged at an angle to the first portion of the tool handle and having a first end and a second end and being fixed at the first end to the second end of the first portion of the tool handle, said angle being a lateral angle arranged such that the handle grip extends laterally of the longitudinal center line of the first portion and such that the longitudinal center line of the first portion lies substantially in a vertical plane passing through the forearm of the person when the handle grip is gripped in the hand and when the forearm is positioned substantially parallel to a horizontal plane.

Preferably the angle at which the handle grip lies relative to the first portion of the tool handle is a compound angle comprising said lateral angle and a vertical angle, said compound angle being arranged such that the handle grip extends into the gripping hand of the person and the longitudinal center line of the first portion of the handle lies substantially parallel to the forearm of the person and substantially in the vertical plane passing through the forearm of the person when the forearm is positioned substantially parallel to a horizontal plane.

The ergonomically redesigned hammer includes the improved handle which reduces the risk of repetitive strain injuries. An extended fulcrum point is located at the top of the hammer head and is arranged to improve the nail extracting characteristics of the hammer claw. The hammer claw has claw members that are angled relative to one another enabling the claw to access nails located in corners, along baseboards, and at other locations where two

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surfaces meet at an angle. An offset striking member is provided to improve the ability of the individual using the hammer to see the work area and improves the striking efficiency of the hammer. Additional striking surfaces have been added to the sides of the hammer head to allow the hammer to be  
5 used in applications where this may be advantageous. The hammer handle, as well as the improvements discussed above, includes the further improvement of being made from laminated materials which increases the strength of the hammer handle and helps dampen vibration. An add-on fulcrum extension and replacement handle are provided for upgrading existing hammers.

10 An improved paint brush and scissors are also provided. Both the paint brush and the scissors include the improved handle arrangement. The paint brush is provided with a handle extension making the paint brush usable when painting in locations that would normally be out of reach of the individual.

15 The improved handle is adaptable for use with many currently used non-powered hand tools, powered hand tools, horticultural implements, writing and office implements, edge tools, striking and impact tools, cutting tools, ripping and riveting tools, fastening hand tools, and forging and shearing tools. The improved handle may also be employed for use with sports  
20 equipment, kitchen utensils, and equipment controls as well as in any other application where its use would be appropriate.

#### BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings, which illustrate an exemplary embodiment of the present invention:

25 Figure 1 is a side view of the improved ergonomic hammer.



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Figure 2 is a top view of the improved ergonomic hammer having a cutout showing the laminated handle.

Figure 3 is a side view of a hammer showing the add-on fulcrum and improved handle.

5           Figure 4 is a view of the ergonomic hammer through line BB of Figure 2.

Figure 5 is a side view of the ergonomically improved paint brush.

Figure 6 is a top view of the ergonomically improved paint brush.

10           Figure 7 is a side view of a paint brush showing a replacement handle and handle extension.

Figure 8 is a top view of a paint brush showing a replacement handle and handle extension.

Figure 9 is a top view of the ergonomically improved scissors.

Figure 10 is a side view of the ergonomically improved scissors.

15    **DETAILED DESCRIPTION**

20           The ergonomically improved hand tools include an improved handle which has a handle grip portion set at an angle to the remainder of the tool handle. The angle at which the handle grip is set to the remainder of the tool handle is a compound angle which brings the tool head into alignment with the forearm of the individual using the tool. The handle helps reduce many of the inefficiencies associated with conventional hand tool handle designs and helps reduce the risk of repetitive strain injuries. A hammer, paint brush, and scissors each employing the improved handle and other improvements are provided below.

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Referring to Figures 1 to 4 the ergonomically improved hammer is shown generally at 10. The hammer 10 comprises the handle 12 and a hammer head 14. The handle 12 comprises a first portion 16 and a handle grip 18 fixed at an angle to the first portion 16. The hammer head 14 comprises a  
5 body 20, striking member 22, a fulcrum member 24, and a hammer claw 26.

The first portion 16 of the hammer handle 12 has a first end 28 and a second end 30. The first portion 16 is substantially straight extending between the first end 28 and the second end 30 and is fixed at the first end 28 to the hammer head 14. A longitudinal center line 32 extends through the first  
10 portion 16.

The handle grip 18 has a first end 34 and a second end 36 and is fixed at the first end 34 to the second end 30 of the first portion 16 of the tool handle 12. The handle grip 18 is arranged at an angle 38 to the first portion 16. The angle 38 is a compound angle and has a lateral component 40 and a  
15 vertical component 42. As a result of the compound angle 38 the handle grip 18 extends laterally of the longitudinal center line 32 of the first portion 16 and extends downwards from the first portion 16 when the first portion 16 lies in a horizontal plane.

When the handle 12 is held in the hand 11 of an individual with  
20 the forearm 13 of that individual positioned substantially parallel to a horizontal plane the lateral angle 40 brings the handle 10 and hammer head 14 into a line with the forearm 13 such that the longitudinal center line 32 of the first portion 16 lies substantially in a vertical plane 17 passing through the forearm 13. The vertical angle 42 brings the hammer head 14 and first portions 16 of the tool  
25 handle 12 down into line with the forearm 13 such that the longitudinal center

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line 32 of the first portion 16 of the handle 12 lies substantially parallel to the forearm of the individual. This brings the first portion 16 of the handle 12 and the hammer head 14 into alignment with the forearm 13 and allows the hammer 10 to be used without bending the wrist laterally to bring the hammer head 14 into striking position. This also brings the hammer head 14 into a position where it does not interfere with the line of sight between the individual and the working area, and helps reduce the vertical range of motion through which the wrist travels thereby keeping the wrist operating in the middle third of its vertical range of motion thus reducing the risk of repetitive strain injuries.

10 It has been found that the best arrangement of the compound angle 38 provides a lateral angle 40 of  $19^\circ$  to the longitudinal center line 32 and a vertical angle 42 also  $19^\circ$  to the longitudinal center line 32. Acceptable results can be obtained using arrangements having a lateral angle 40 lying in the range between  $8^\circ$  and  $30^\circ$  from the longitudinal center line 32 and a vertical angle 42 lying in the range of between  $8^\circ$  and  $30^\circ$  from the longitudinal center line 32.

The handle 12 is of laminated material comprising a plurality of elongate laminated members 47. The elongate laminated members 47 extend longitudinally along the handle 12 and are usually held together by an adhesive.

20 The use of laminated material in the handle 12 reduces vibrations due to shock and impact when striking with the hammer 10 and provides superior strength when compared to similar nonlaminated materials.

The body 20 of the hammer head 14 comprises a front end 46, a rear end 48, a first side 50, a second side 52, a top end 54, and a bottom end

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56. An attachment means 58 is arranged at the bottom 56 for attaching the hammer head 14 to the first end 28 of the tool handle 12.

The attachment means 58 comprise an opening 60 extending through the hammer head 14 from the bottom 56 through to the top 54 of the  
5 hammer head 14. The opening 60 is arranged to receive the first end 28 of the first portion 16 of the handle 12 and frictionally secure the handle 12 within the opening 60 and thereby to the hammer head 14.

The striking member 22 is fixed to the front end 46 of the hammer head 14 and extends forwards from a first end 62 fixed to the front end 46 of  
10 the hammer head 14 to a second end 64. The striking member 22 extends forwards of the body 20 at an angle angling in a direction towards the handle grip 18 of the handle 12. A striking face 66 is fixed at the second end 64 of the striking member 22. The striking face 66 is arranged to lie substantially parallel to the first portion 16 of the handle 12 and to the longitudinal center  
15 line 32 extending therethrough. Setting the striking member 22 at an angle to the body 20 of the hammer head 14 improves the visibility of the work area and increases the striking efficiency of the hammer head 14.

The fulcrum member 24 is arranged at the top 54 of the body 20 of the hammer head 14 and extends upwards from the top 54 of the body 20  
20 to an apex 68 spaced from the top 54. The fulcrum member 24 is arranged such that the apex 68 lies at a location offset from the longitudinal center line 32 of the first portion 16 of the handle 12 towards the rear end 48 of the body 20 of the hammer head 14. The fulcrum member 24 extends downwards and rearwards in a curve from the apex 68 to the hammer claw 26 and extends

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downwards and forwards in a curve from the apex 68 to the top 54 of the body 20 of the hammer head 14.

The efficiency with which the hammer 10 can withdraw nails is enhanced by the fulcrum member 24 which provides for greater leverage when drawing a nail engaged within the claws 26.

The hammer claw 26 comprises a pair of spaced apart claw members 70 each having a first end 72 and a free second end 74. Each of the claw members 70 is fixed at the first end 72 to the rear end 48 of the body 20 of the hammer head 14 and extends downwards and rearwards therefrom to the second end 74. The claw members 70 are arranged such that they diverge from one another as they extend from the rear end 48 in a direction from the first end 72 to the second end 74. This provides a slot 76 for engaging nails or other fasteners when withdrawing them from a member into which they have been introduced.

The claws 26 are arranged such that they curve steeply from the second end 74 of each claw member 70 upwards to the apex 68 of the fulcrum member 24. This enhances the ability of the hammer claw 26 to withdraw a nail by drawing the nail more straightly thereby requiring less force and making the task easier for the individual performing it.

Each claw member 70 includes an inner side edge 78 and an outer side edge 80 lying opposite the inner side edge 78. The claw members 70 are arranged at an angle relative to one another such that the outer side edge 80 at the second end 74 of each respective claw member 70 lies adjacent the handle 12 and such that each claw member 70 angles rearwards and inwards from its respective outer side edge 80 to its respective inner side edge 78. Having the

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claw members arranged at an angle to one another instead of being aligned with one another allows an individual using the hammer to withdraw nails in corners, along baseboards, and any other location where two surfaces join at an angle.

5           When performing some tasks with a hammer 10 it is sometimes advantageous to strike a surface with a side of the hammer head 14. This is usually not recommended when using most conventional hammers. The ergonomic hammer 10 includes a striking face 69 on each of the first and second sides 50 and 52 of the hammer head 14. The striking face 69 and the  
10 stronger laminated handle 12 enables an individual to use the hammer in this manner.

          In an alternative arrangement the handle 12 and fulcrum 24 may be provided as add-on components for use with existing hammers to convert the hammer into a more ergonomic tool. Referring to Figure 4 the fulcrum  
15 member 24 is shown as a separate component with a removable and reengageable connection means 84 for connecting the fulcrum member 24 at the top 54 of the body 20 of the hammer head 14. The removable and reengageable connection means may be any appropriate means, one example of which is a pair of tack members 86 fixed to a bottom 88 of the fulcrum  
20 member 24 for engaging through the opening 60 in the top 54 of the hammer head into the first end 28 of the first portion 16 of the tool handle 12. The tacks 86 frictionally secure the fulcrum member 24 in place on the top of the hammer.

          The ergonomically designed handle 12 may be employed with any  
25 tool where its application would be appropriate and may be provided with

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various different attachment configurations at the first end 28 for engaging the bottom 56 of the tool head.

In another alternative arrangement a paint brush 100 is provided having a ergonomically designed handle 102 which includes the compound  
5 angle 38 having the vertical component 42 and the lateral component 40. The handle 102 like the handle 12 on the hammer 10 brings the working head 104 of the paint brush into correct alignment with the forearm of the individual.

The paint brush handle 102, like that of the hammer 10, has a first portion 16 having a longitudinal center line 32 extending therethrough and a  
10 handle grip 18 arranged at a compound angle 38 to the first portion 16. The compound angle 38 is the same as that on the hammer 10. The first portion 16 of the paint brush handle 102 is fixed to the body 106 of the paint brush head 104 which in turn is fixed to the bristles 108 of the paint brush 100.

In another alternative arrangement the paint brush handle 102 may  
15 be detachable from the body 106 from the paint brush head 104 such that it can be connected to existing paint brushes as a replacement component thereby converting the conventional paint brush into an ergonomic paint brush.

An extension arm 110 may be provided for existing paint brushes. The extension arm 110 would include a first portion 16, a longitudinal center  
20 line 32 and a handle grip 18 fixed at the compound angle 38 to the first portion 16. This allows a regular paint brush to be used with an ergonomic handle for reaching into locations which would otherwise be outside the reach of the individual.

In another alternative embodiment an ergonomic handle 120 is  
25 shown in use with a pair of scissors 121. The ergonomic handle 120 includes

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the first portion 16, the longitudinal center line 32 passing through the first portion 16, and the handle grip 18 arranged at the compound angle 38 to the longitudinal center line 32. Like the paint brush 100 and the hammer 10 the compound angle 38 in the handle 120 allows the working end 122, in this case  
5 shears, to be correctly aligned with the forearm of the individual using the scissors 121, allowing the scissors 121 to be used in a more comfortable position and allowing better visibility of the area being cut.

While one embodiment of the present invention has been described in the foregoing, it is to be understood that other embodiments are  
10 possible within the scope of the invention. The invention is to be considered limited solely by the scope of the appended claims.



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## CLAIMS:

1. A hand tool for gripping in a gripping hand of an arm of a person, said arm having a forearm, said hand tool comprising:

a tool head;

5 and tool handle including:

a first portion having a first end, a second end, and a longitudinal center line extending therethrough, said first portion being fixed at the first end to the tool head;

10 and a handle grip arranged at a compound angle to the first portion of the tool handle and having a first end and a second end and being fixed at the first end to the second end of the first portion of the tool handle, said compound angle including:

15 a lateral angle arranged such that the handle grip extends laterally of the longitudinal center line of the first portion and such that the longitudinal center line of the first portion of the handle lies substantially in a vertical plane passing through the forearm of the person; and

20 a vertical angle within said vertical plane passing through the forearm of the person such that the longitudinal center line of the first portion of the handle lies substantially parallel to the forearm of the person when the forearm is positioned substantially parallel to a horizontal plane and when the handle grip is gripped in the hand.

2. A hand tool in accordance with Claim 1 wherein the lateral angle is an angle lying in a range between 8 and 30 degrees.

3. A hand tool in accordance with Claim 1 wherein the lateral angle

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is an angle lying in a range between 15 and 23 degrees.

4. A hand tool in accordance with Claim 1 wherein the vertical angle is an angle lying in a range between 8 and 30 degrees.

5. A hand tool in accordance with Claim 1 wherein the vertical angle is an angle lying in a range between 15 and 23 degrees.

6. A hand tool in accordance with any one of Claims 1, 2, 3, 4 or 5 wherein the tool head is a hammer head.

7. A hand tool in accordance with Claim 6 wherein the hammer head includes:

10 a body having a front end, a rear end, a first side, a second side, a top, a bottom, and attachment means arranged at the bottom for attaching the hammer head to the first end of the tool handle;

and a striking member extending forwards from the front end of the body of the hammer head to a striking face, said striking member extending forwards  
15 of the body at an angle to the body in a direction towards the handle grip of the tool handle, and said striking face being arranged substantially parallel to the first portion of the tool handle.

8. A hand tool in accordance with Claim 6 wherein the hammer head includes:

20 a body having a front end, a rear end, a first side, a second side, a top, a bottom, and attachment means arranged at the bottom for attaching the hammer head to the first end of the tool handle;  
a striking member extending forwards from the front end of the body to a striking face;

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a fulcrum member extending upwards from the top of the body to an apex spaced from said top;

and a hammer claw having a pair of spaced apart claw members each having a first end, and a free second end and being fixed at the first end to the rear end of the body extending downwards and rearwards therefrom to the second end, said claw members being arranged to diverge from one another in a direction from the first end to the second end thereby providing a slot therebetween.

9. A hand tool in accordance with Claim 8 wherein the fulcrum member is arranged on the top of the body of the hammer head such that the apex lies at a location off set from the longitudinal centre line of the first portion of the tool handle towards the rear end of the body of the hammer head, and wherein the fulcrum member extends downwards and rearwards in a curve from the apex of the fulcrum to the claw members and wherein the fulcrum member extends downwards and forwards in a curve from the apex of the fulcrum to the top of the body of the hammer head.

10. A hand tool in accordance with Claim 9 wherein the fulcrum member includes removable and re-engageable connection means for connecting the fulcrum member at the top of the body of the hammer head.

11. A hand tool in accordance with Claim 10 wherein the attachment means arranged at the bottom of the body of hammer head comprise an opening extending through the hammer head from the bottom to the top thereof, said opening being arranged to receive the first end of the first portion of the tool handle therein thereby frictionally securing the tool handle to the hammer head; and wherein the removable and re-engageable connection means of the fulcrum member

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comprise a fastener for engaging the first end of the first portion of the tool handle through the opening in the top of the body of the hammer head.

12. A hand tool in accordance with Claim 8 wherein each claw member includes an inner side edge lying adjacent the slot and an outer side edge  
5 lying opposite the inner side edge, and wherein the claw members are arranged at an angle relative to one another such that the outer side edge of the second end of each respective claw member lies adjacent the tool handle and such that each claw member angles rearwards and inwards from its respective outer side edge to its respective inner side edge.

10 13. A hand tool in accordance with any one of Claims 7, 8, 9, 10, 11 or 12 wherein the hammer head includes a striking face on each of the first and second sides thereof.

14. A hand tool in accordance with any one of Claims 1, 2, 3, 4 or 5 wherein the handle is of laminated material having a plurality of laminated members  
15 arranged such that each one of the plurality of laminated members extends longitudinally along the handle.

15. A hand tool in accordance with any one of Claims 6, 7, 8, 9, 10, 11, 12, 13, or 14 wherein the handle grip is removably and re-engageably fixed at the first end to the second end of the first portion of the handle.

20 16. A hand tool in accordance with any one of Claims 1, 2, 3, 4 or 5 wherein the tool head is a paint brush head.

17. A hand tool in accordance with any one of Claims 1, 2, 3, 4 or 5 wherein the tool head is shears.

18. A handle for gripping in a hand of an arm of a person, said arm

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having a forearm, and for use with a tool having a tool head, said handle comprising:

a first portion having a first end, a second end, and a longitudinal center line extending therethrough, said first portion being fixed at the first end to the tool head;

- 5 and a handle grip arranged at a compound angle to the first portion of the tool handle and having a first end and a second end and being fixed at the first end to the second end of the first portion of the tool handle, said compound angle including:

- a lateral angle arranged such that the handle grip extends laterally of  
10 the longitudinal center line of the first portion and such that the longitudinal center line of the first portion of the handle lies substantially in a vertical plane passing through the forearm of the person; and

- a vertical angle within said vertical plane passing through the forearm of the person such that the longitudinal center line of the first portion of the handle  
15 lies substantially parallel to the forearm of the person when the forearm is positioned substantially parallel to a horizontal plane and when the handle grip is gripped in the hand.

19. A handle in accordance with Claim 18 wherein the lateral angle is an angle lying in a range between 8 and 30 degrees.

- 20 20. A handle in accordance with Claim 18 wherein the lateral angle is an angle lying in a range between 15 and 23 degrees.

21. A handle in accordance with Claim 18 wherein the vertical angle is an angle lying in a range between 8 and 30 degrees.

22. A handle in accordance with Claim 18 wherein the vertical angle

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Is an angle lying in a range between 15 and 23 degrees.

23. A handle in accordance with any one of Claims 18, 19, 20, 21 or 22 for a tool head comprising a hammer head.

24. A handle in accordance with any one of Claims 18, 19, 20, 21 or 22 wherein the handle is of laminated material having a plurality of laminated members arranged such that each one of the plurality of laminated members extends longitudinally along the handle.

25. A handle in accordance with any one of Claims 18, 19, 20, 21 or 22 wherein the handle grip is removably and re-engageably fixed at the first end to the second end of the first portion of the handle.

26. A handle in accordance with any one of Claims 18, 19, 20, 21 or 22 for a tool head comprising a paint brush head.

27. A handle in accordance with any one of Claims 18, 19, 20, 21 or 22 for a tool head comprising shears.

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**ABSTRACT**

The ergonomically improved hand tools include an improved handle which has a handle grip portion set at an angle to the tool head. The angle at which the handle grip is set to the remainder of the tool handle is a compound angle arranged such that the handle grip portion extends laterally of the remainder of the handle and angles downwards vertically into the hand when being gripped. This compound angle has the benefits of the Bennett handle as well as brings the tool head into alignment with the forearm of the individual using the handle which the Bennett handle fails to do. The improved hand tool handle is adaptable for use with most currently used hand tools and may be employed in any application where its use would be appropriate. The ergonomically improved hand tools provide an ergonomically redesigned hammer having the improved handle which reduces the risk of repetitive strain injuries. An extended fulcrum point is located at the top of the hammer head for improving the nail extracting characteristics of the hammer claw. The hammer claw has claw members that are angled relative to one another enabling the claw to access nails located in corners, along baseboards and at other locations where two surfaces meet at an angle. The hammer handle as well as the improvements discussed above includes the further improvement of being made from laminated materials which increases the strength of the hammer handle and helps dampen vibration. An improved paint brush and scissors are also provided. Both the paint brush and the scissors include the improved handle arrangement.